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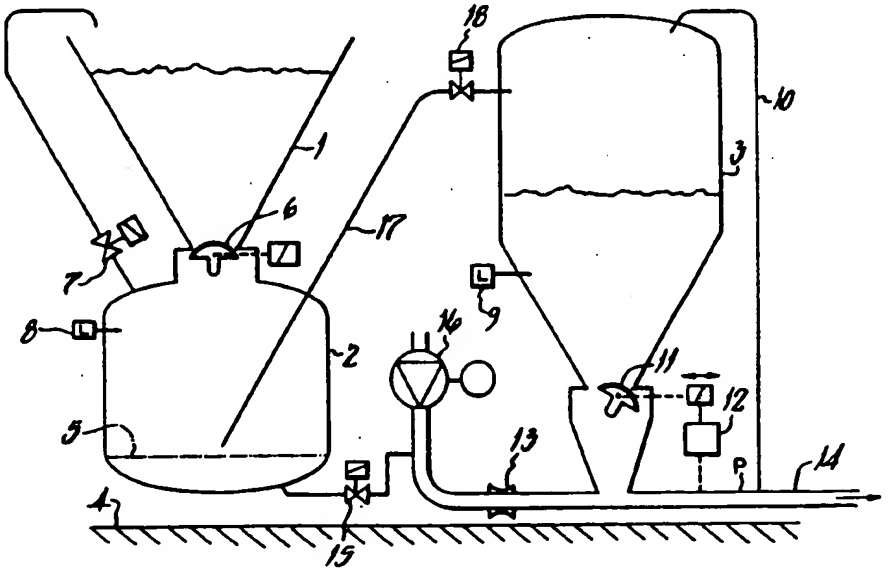
(54) Material conveying apparatus

(57) A device for the continuous introduction of bulk material into a pneumatic conveying conduit comprising a first vessel (2) gravity fed with material through a valved top inlet (6) from a hopper (1), and a second vessel (3) connected via line (17) to the first vessel (2). When required, eg when the material level falls below sensor 9, vessel (3) is topped up with material pneumatically forced along line (17) from vessel (2), and vessel (3) dispenses the material via controlled valve (11) into conduit (14) which is connected to compressor (16). The low level top inlet valve (6) of vessel (2) enables the system to be installed in a location where there is a height limitation.



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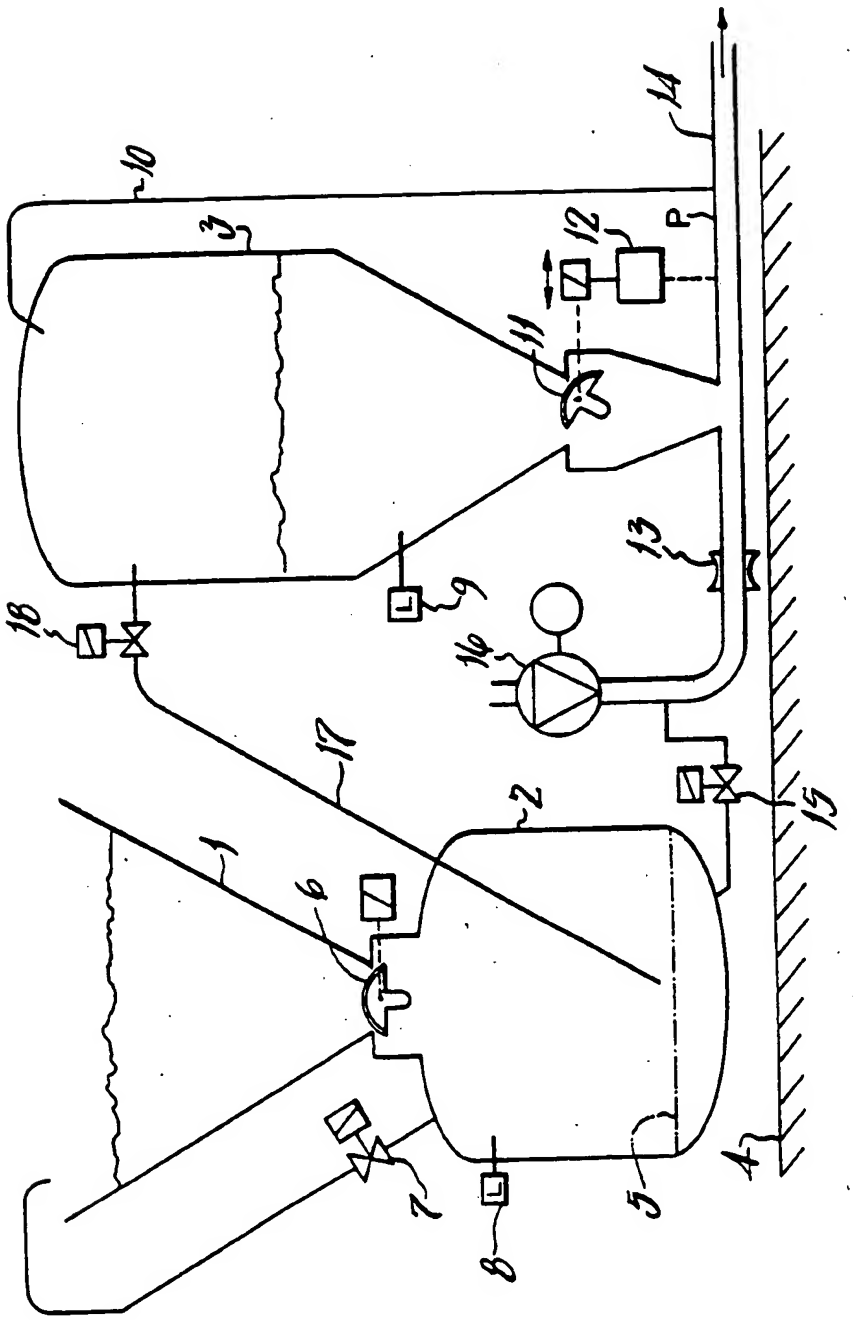

SPECIFICATION

Material conveying apparatus

THIS INVENTION relates to a device for the continuous introduction of bulk material into a pneumatic conveying conduit.

The invention is intended for use in areas where there is a height limitation between the outlet of the bulk storage and ground level. Present continuous feed device which can operate with low heights are ejectors, rotary feed valves or rotary screw pumps. They have the disadvantages of, a) limitation on operation pressures, b) high wear rates of the moving parts, and, c) high power consumption for the moving parts.

Blow tanks, which are a conventional method of pneumatic transport could also be used, but because of the low height limitations the blow tanks would be quite small and because of their cyclic manner would not provide the conveying rates afforded by the constant feed devices previously described.

There are known methods of using two blow tanks situated side-by-side and working on alternative cycles to provide a continuous material input into the conveying conduit, however, this does not resolve the height problem since the inlets for both vessels are by necessity positioned some distance apart and chutes from one outlet on the feeding bunker to both inlets would require considerable height to achieve flow by gravity.

Known principles of regulating the material flow continuously into the conveying conduit, are rotary valve feeders, screw feeders, and gravity flow devices with pressure feed back signals to regulate material flow in accordance with conveying conduit pressure.

The above known methods are capable of feeding materials into the conveying conduit continuously using pressure vessels as material pressure locks by locating one vessel on top of the other vessel with valves between each vessel and a valve on the inlet of the top vessel to allow material to gravity flow first into the top vessel and then by gravity into the bottom vessel which contains the material feeding device. This bottom vessel is kept under constant pressure, similar to that of the conveying conduit, and the top material and air inlet valves operated in a manner which prevents pressure escape but allows material to gravitate into the feeding vessel. However, the major problem with this arrangement is that it is a relatively tall assembly and can therefore not be used in a system where there is a height limitation.

The present invention is based on the provision of two vessels adjacent to one another, one acting as a "lock vessel", the other as a "feeding vessel". The "lock vessel" is smaller that the "feeding vessel", and is used on a cyclic basis to replenish material which is continuously discharged from the feeding vessel. Since the lock vessel has only to convey material the short distance between the two vessels, it can cycle frequently and hence be of a relatively small volume in relation to the amount of material being conveyed through the system. The actual discharge rate from the feeding vessel is controlled by the conveying conduit pressure. The objective is to maintain a constant set line pressure by the regulation of material flow into the conveying conduit.

According to the invention, there is provided a device for the introduction of bulk material into a pneumatic conveyor conduit comprising a first vessel having a top material inlet valve and a material outlet, a supply means for compressed gas, and a second vessel having an outlet to the conveying conduit including means to regulate the flow of material into the latter, the material outlet of the first vessel being coupled to the second vessel such that material is pneumatically conveyed thereto from the first vessel to re-fill the second vessel when required to ensure a continuous flow of material into the conveying conduit, the first vessel being situated adjacent the second vessel, and connected to a bulk storage means which has its outlet to the first vessel at a level below the level of the top of the second vessel.

Thus the device may be used in a system where there is a height limitation. The means to regulate the flow of material into the conduit may typically be a rotary valve feeder, a screw feeder or a gravity flow device with a pressure feed back system.

Preferably, the means for regulating material flow into the conveying conduit is connected to pressure sensing means and to control means to adjust the material flow dependent upon the pressure in the conduit.

An example of the device in accordance with the invention will now be described by way of example only with reference to the accompanying schematic drawing.

A bulk feeding hopper 1 is situated with its outlet over the top inlet of a first vessel 2 which is at low level above the ground 4. Air from a blower 16 picks up material falling from a second vessel 3 by gravity through a valve 11 which is regulated by a control system 12 including pressure sensing means to allow the correct amount of material into a conveying conduit 14 dependent upon a constant pre-determined pressure in the part of the conduit indicated by reference P.

Vessel 3 holds material, and the pressure in the top of the vessel is kept the same as at P by a balance line 10. When material in vessel 3 is above level sensor 9, two valves 18 and 15 are held closed. When the level of material falls below sensor 9, two valves 6 and 7 are opened allowing bessel 2 to fill to its level sensor 8. Then valves 6 and 7 close

and valve 15 is opened to admit pressurised air int the base f vessel 2 until the pressur is equal to that in vessel 3 before valve 18 is opened. The pressure differential caused by a restriction 13 in conduit 14 causes material to be pneumatically conveyed from vessel 2 through conduit 17 into vessel 3. When transfer of material is complete valves 18 and 15 are closed. During transfer from vessel 2 to vessel 3 the air used for conveying vents through balance pipe 10. Membrane 5 in the base of vessel 2 is a fluidising membrane or similar device to aerate the product before conveying it to vessel 3. The cycle is repeated when the material level falls below level sensor 9.

CLAIMS

1. A device for the introduction of bulk material into a pneumatic conveying conduit comprising a first vessel having a top material inlet valve and a material outlet, a supply means for compressed gas, and a second vessel having an outlet to the conveying conduit including means to regulate the flow of material into the latter, the material out let of the first vessel being coupled to the second vessel such that material is pneumatically conveyed thereto from the first vessel to re-fill the second vessel when required to ensure a continuous flow of material into the conveying conduit, the first vessel being situated adjacent the second vessel and connected to a bulk storage means which has its outlet to the first vessel at a level below the level of the top of the second vessel.

2. A device according to Claim 1, wherein the means to regulate the flow of material into the conveying conduit is a gravity flow device with a feed-back system.

3. A device according to Claim 1 or Claim 2, in which the means for regulating material flow into the conveying conduit is connected to control means including pressure sensing means thus to adjust the material flow dependent upon a predetermined pressure in the conduit.

4. A device according to any preceding claim, including means in the base region of said first vessel to fluidise the material therein and wherein said supply means for compressed gas is connected to said conveying conduit.

5. A device according to any preceding claim, including a balance line between the conveying conduit and said second vessel to ensure equalised pressures therein.

6. A d vice according t any preceding claim, including a plurality of control valves t cause material to be c nv yed from said first t said second vessel when the l vel of material in the latter falls below a predetermined level.

7. A devic according to any preceding claim, wherein said first vessel is gravity fed with material fr m said bulk st rag means via said top material inlet valve.

8. A device according to any preceding claim, wherein said first vessel includes level sensing means to cause operation of said top material inlet valve when the material in said first vessel falls below a predetermined level.

9. A device for the introduction of bulk material into a pneumatic conveying conduit, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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